OPERATOR'S MANUAL

HOLOGRAPHIC LASER SYSTEM

Serial No: ______________________

Customer: CNVEO

Operating Voltage/Frequency: ____________

Ed

We have an HLS-2.

Mil N.

703-664-1968

JK Lasers Limited
Somers Road, Rugby
Warwickshire, CV22 7DC
Englar

HOLOGRAPHIC LASERS

TABLE OF CONTENTS

COMPONENT LAYOUT FOR HLS-1

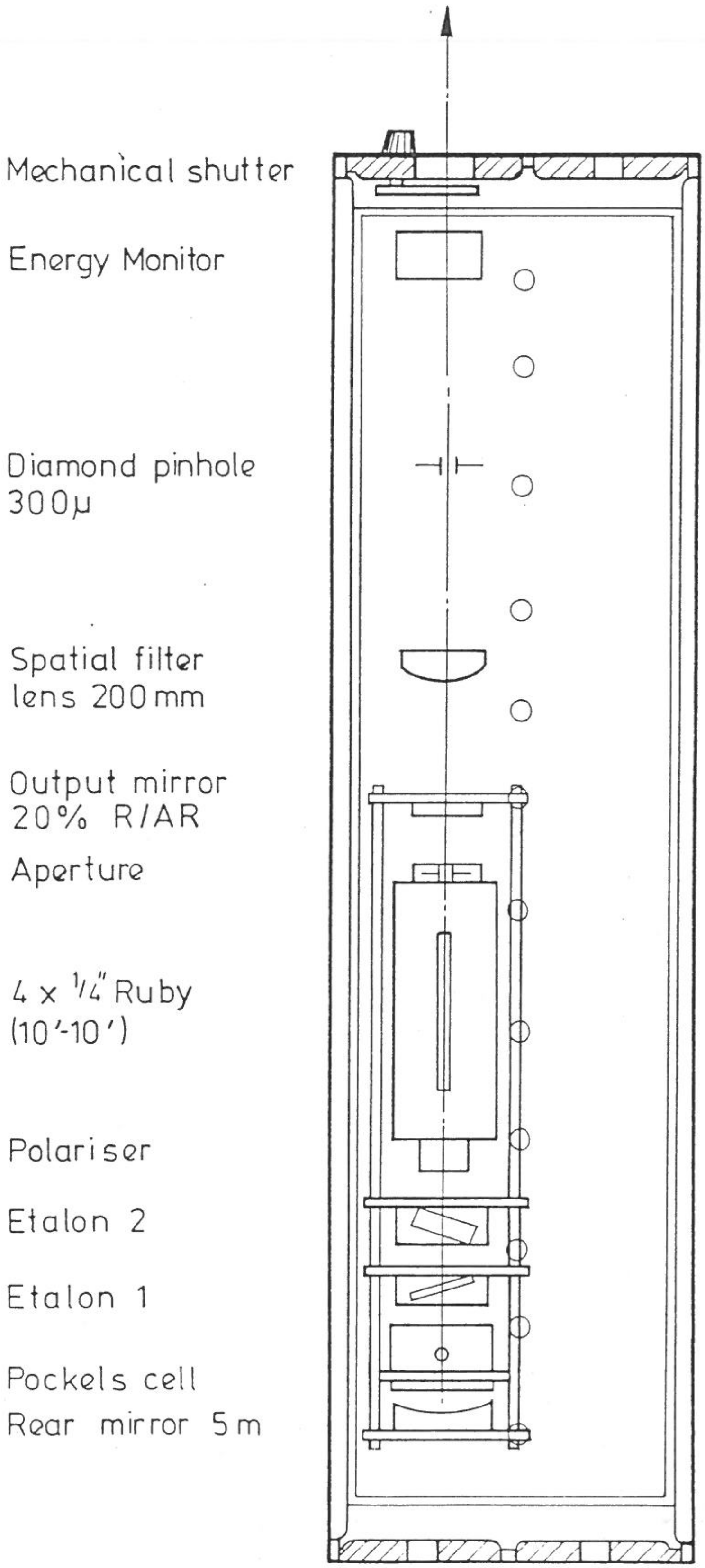


FIG. 1

COMPONENT LAYOUT FOR HLS-2

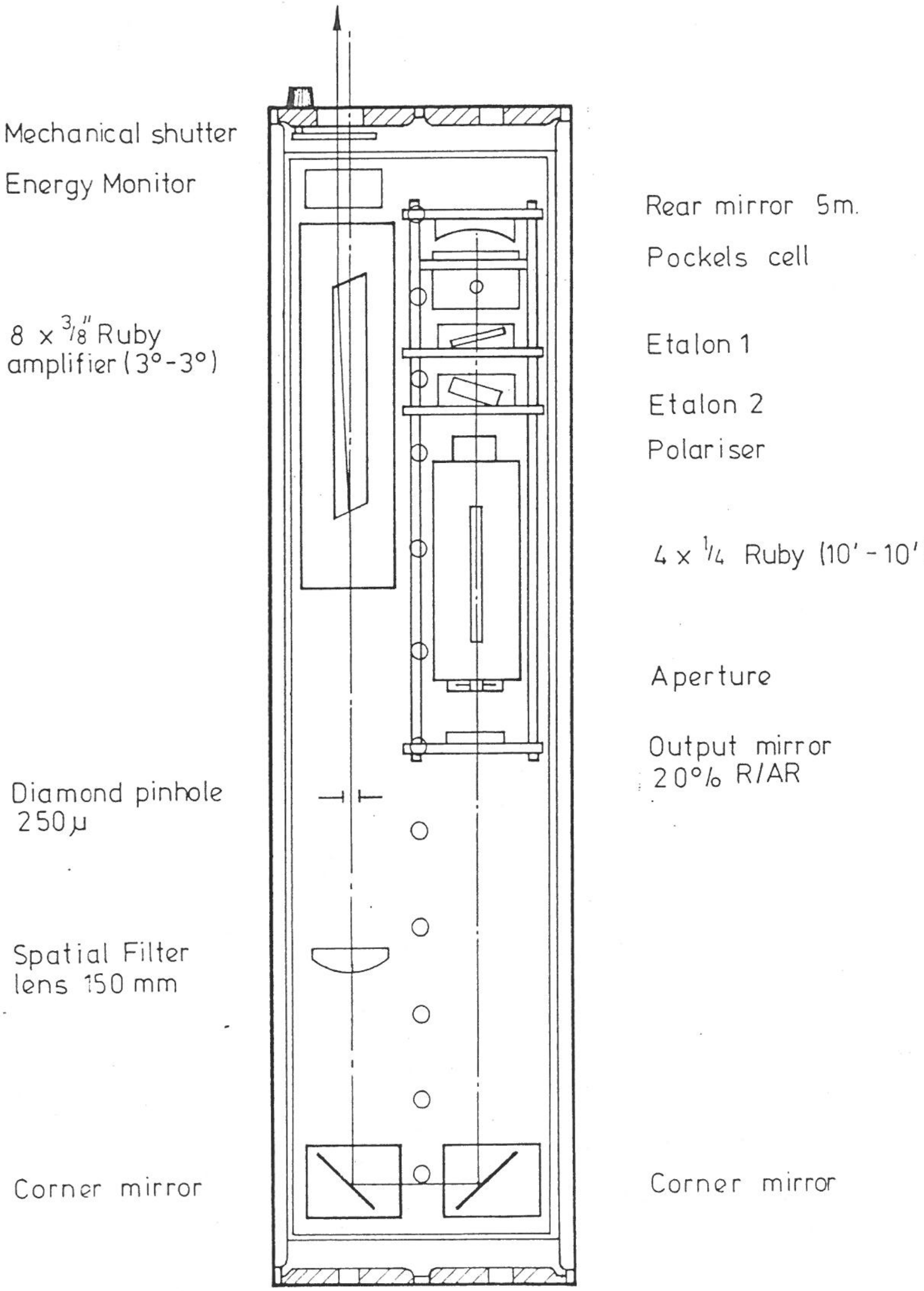


FIG. 1

COMPONENT LAYOUT FOR HLS-3

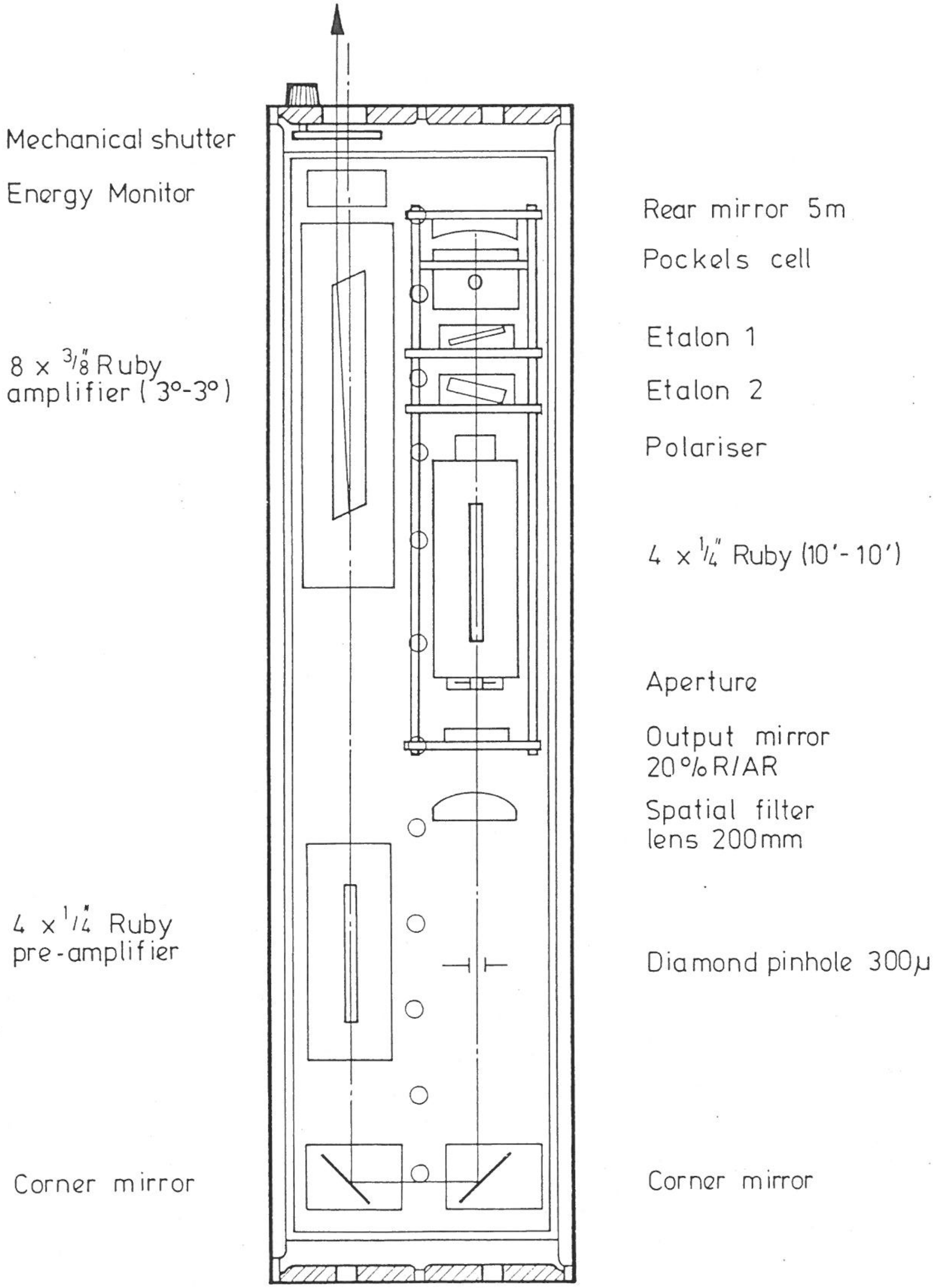


FIG. 1

COMPONENT LAYOUT FOR HLS-4

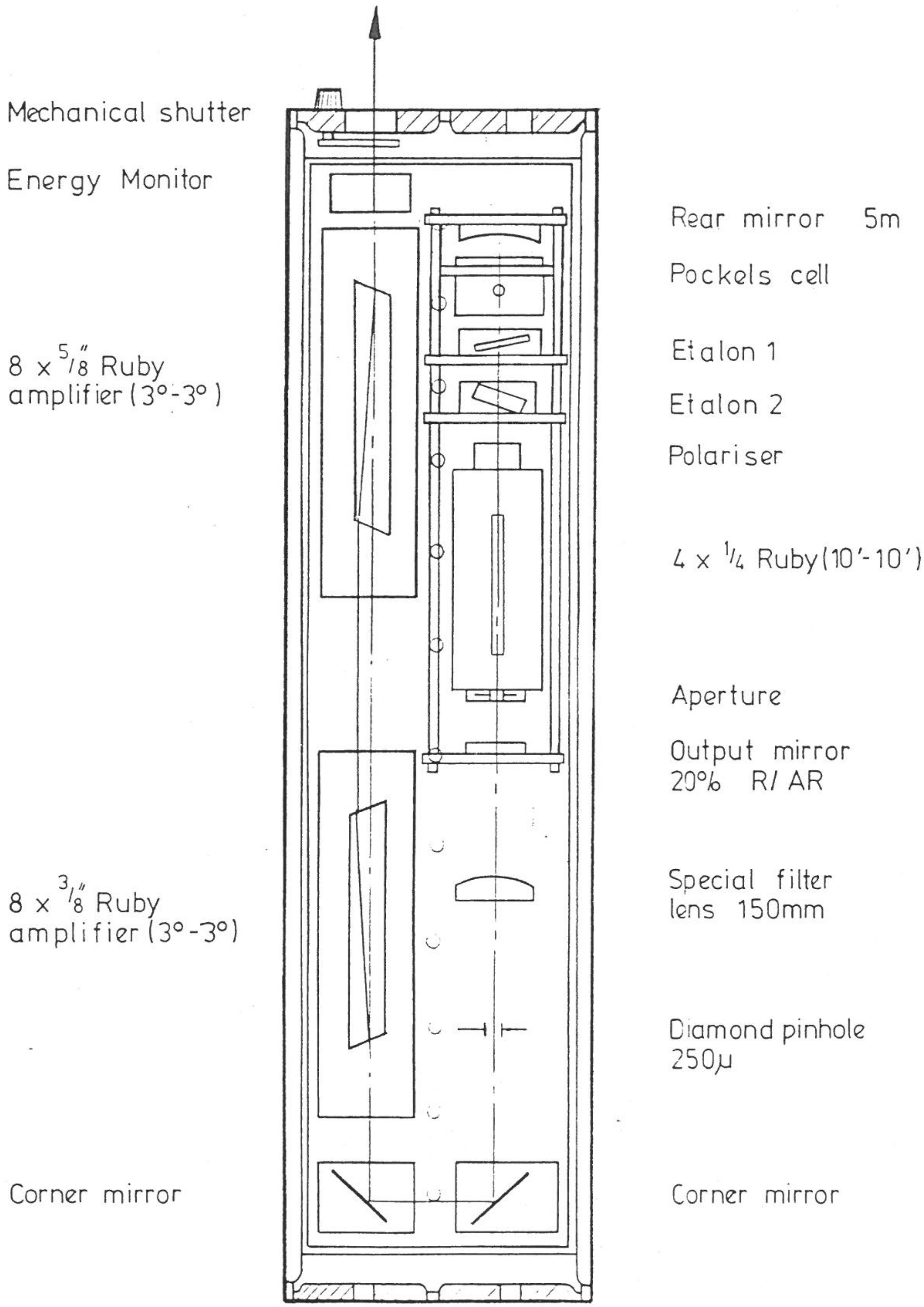
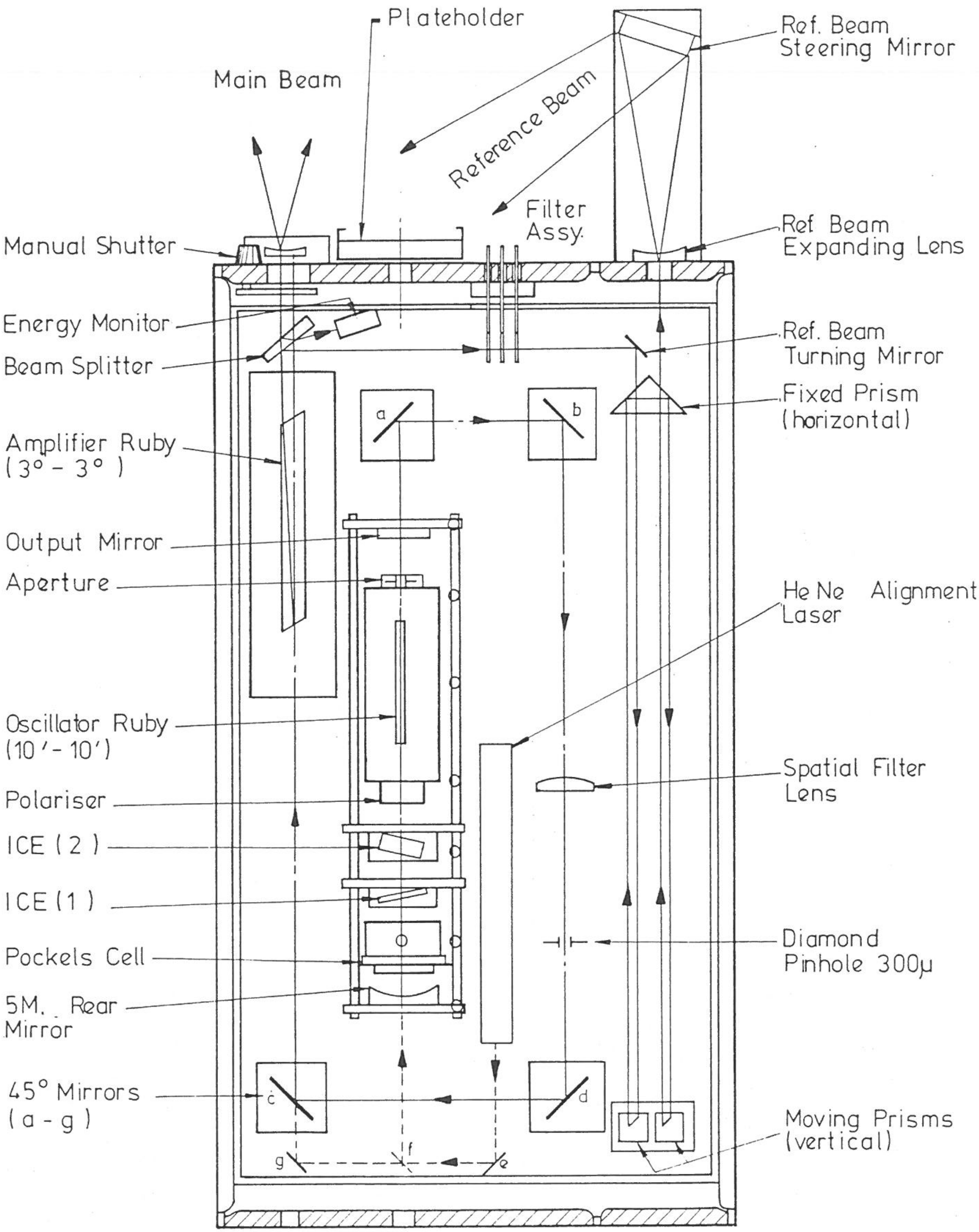
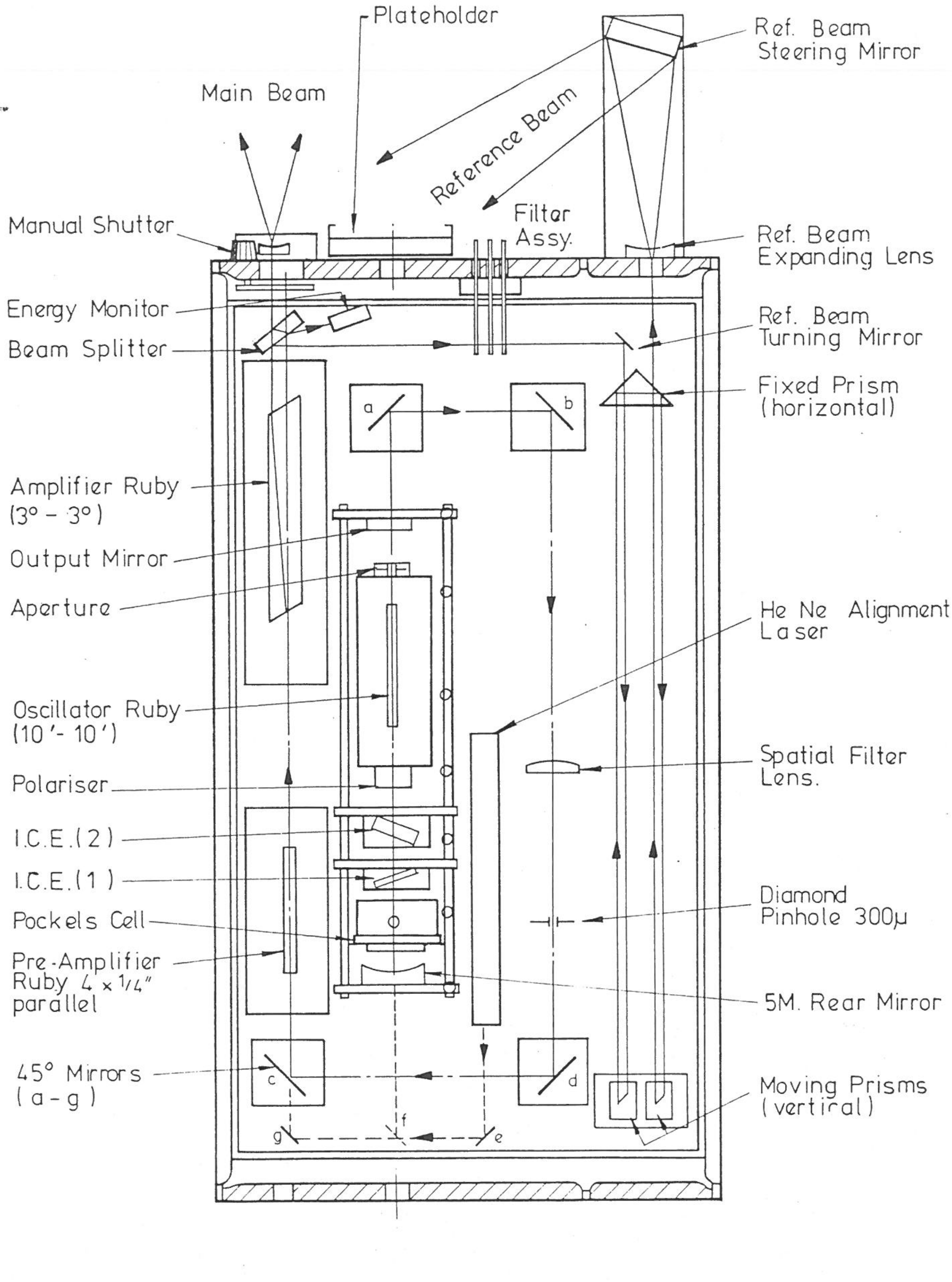


FIG. 1

COMPONENT LAYOUT FOR HLS-2 HOLOCAMERA



COMPONENT LAYOUT FOR HLS-3 HOLOCAMERA



2. SAFETY PRECAUTIONS

This equipment can be extremely dangerous.

2.1. High Voltages

The power supply output is potentially LETHAL and operation with any covers removed should only be carried out by competent technical personnel. Never rely on the automatic discharging system. Always follow the instructions for manual discharge of the capacitors given on the warning labels attached to the laser head and to the inside of the psu cabinets and switch off the mains supply before working on the equipment. If the system has more than one capacitor shorting probe, make sure they are all firmly in their sockets before proceeding.

2.2. Laser Radiation

The laser output is of high intensity and would cause IRREPARABLE DAMAGE TO THE EYES if viewed directly; EYE DAMAGE could also result from diffuse reflections from any surface in the path of the beam. When laser radiation at invisible wavelengths is generated, even more care needs to be taken. SAFETY GOGGLES SHOULD BE WORN AT ALL TIMES by personnel within sight of laser radiation. Ensure that the goggles are suitable for the wavelength(s) being emitted and that they fit snugly.

Extreme care should be taken to ensure a clear path between the laser and the intended target, and safe containment of the beam should it not be absorbed by the target.

An energy dump placed close behind the target is recommended.

Guard against CARELESSNESS, UNTIDINESS AND IMPATIENCE.

Ensure adequate precautions are taken to prevent unauthorised personnel from entering the equipment area when the laser is operating. This can be achieved by interlocking the work area entry door into the laser power supply interlock circuit and/or providing warning notices.

Ensure that the laser controls are always set within the operating specifications for the equipment, and that the laser head cover is always fitted during routine operation. Whilst the cover has to be removed for some adjustments, the laser has been designed so that the need for such removal is minimised and the practice of not replacing the cover is very bad since not only does it increase the danger from stray radiation, but it allows ingress of room dust and dirt to the various optical surfaces.

For further guidance on the safe use of laser equipment, the following is a list of suggested reading material.

1) RADIATION SAFETY OF LASER PRODUCTS AND SYSTEMS. (A GUIDE FOR PROTECTION OF PERSONNEL AGAINST HAZARDS FROM LASER RADIATION.)

   Part 1 - General

   Part 3 - Guidance for users

   BS4803; 1982 British Standards Institution (and subsequent draft revision)

2) LASER SAFETY HANDBOOK

   A Mallow & L Chabot

   Van Nostrand Reinhold Co (PUB) 1978

3) SAFETY IN UNIVERSITIES: NOTES ON GUIDANCE PART 2:1 LASERS (Association of Commonwealth Universities for the Committee of Vice-Chancellors & Principals, 29 Tavistock Square, London WC1.)

4) In the U.S.A. additional information can be obtained from:-
   BUREAU OF RADIOLOGICAL HEALTH (B.R.H.)
   Regulations for the Adminstration and Enforcement of the Radiation Control for Health and Safety Act of 1968 Chapter 21 CFR sub-chapter J.
   available from:-
   U.S. Dept. of Health, Education and Welfare
   Public Health Service,
   Food and Drug Administration Section.

2.3. Solvents

The following solvents recommended for use when maintaining the equipment can be injurious to health unless adequate precautions are taken.

TRICHLOROETHANE : Degreasing solvent for optics. Irritating, harmful vapour. Avoid breathing vapour and contact with skin, eyes and clothing.

PROPAN - 2-OL (ISOPROPANOL, IPA) : Degreasing solvent for optics. Highly flammable. Avoid breathing vapour and contact with eyes.

WARNING : DO NOT SMOKE FOR AT LEAST 30 MINUTES AFTER USING TRICHLOROETHANE. THIS SOLVENT IS TOXIC AND MUST BE USED IN THE OPEN AIR OR A WELL VENTILATED PLACE (e.g. CHEMICAL FUME CUPBOARD).

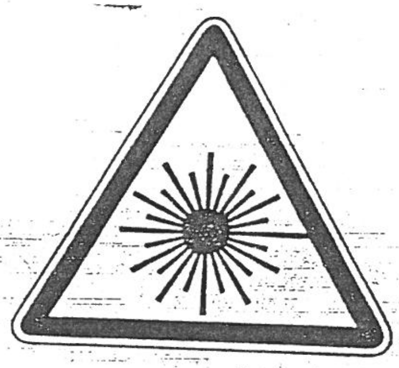
2.4. Safety Labelling

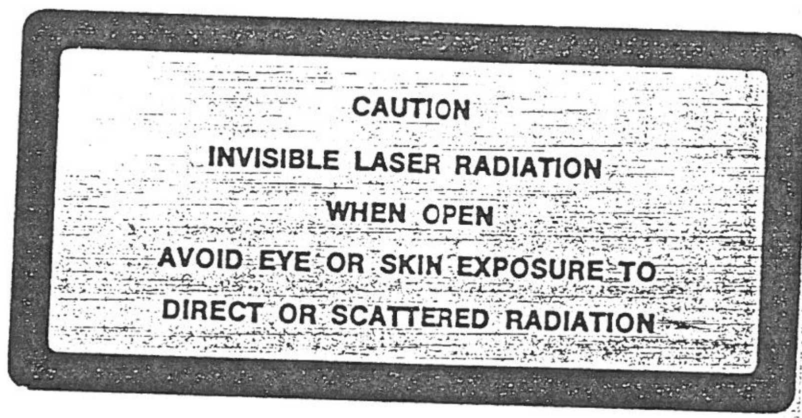
All J K Lasers products are categorised 'Class 4' and safety standards require the prominent display of warning labels as illustrated below.

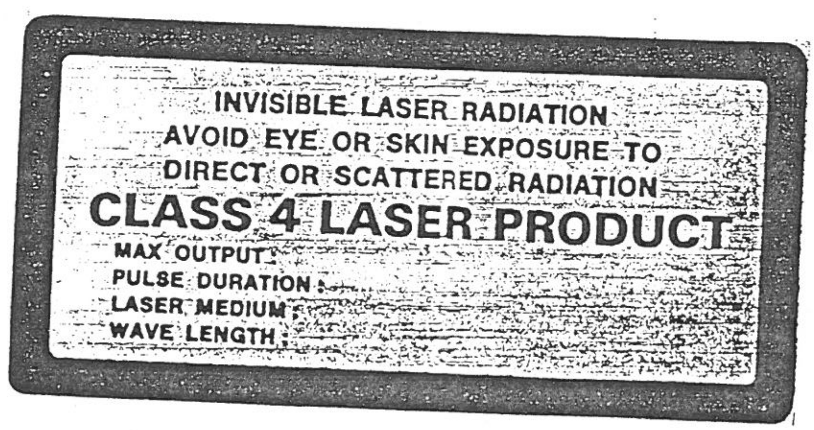
Laser Head Warning Labels

On the outside of the laser head cover.

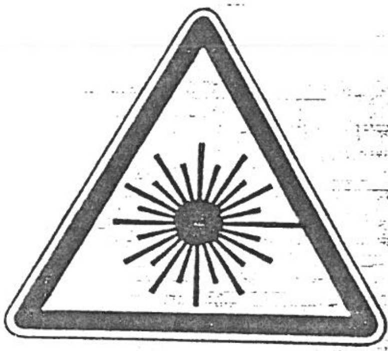
(a) When only invisible radiation is emitted (i.e. outside the range 400-750 nm).







(b) When both visible and invisible radiation may be emitted:



CAUTION
VISIBLE AND INVISIBLE LASER RADIATION
WHEN OPEN
AVOID EYE OR SKIN EXPOSURE TO
DIRECT OR SCATTERED RADIATION

VISIBLE AND INVISIBLE LASER RADIATION
AVOID EYE OR SKIN EXPOSURE TO
DIRECT OR SCATTERED RADIATION
CLASS 4 LASER PRODUCT
MAX OUTPUT:
PULSE DURATION:
LASER MEDIUM:
WAVE LENGTH:

Adjacent to each aperture through which laser radiation may be emitted:

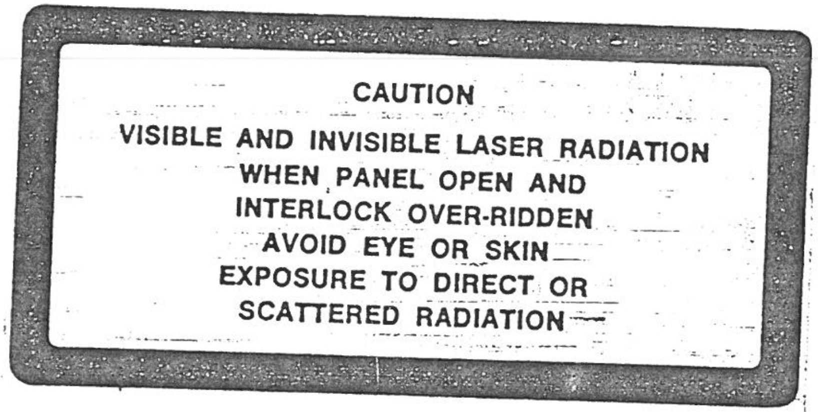
LASER
APERTURE

On the inside of removable covers and on the laser rail, in positions visible when the cover is open.

(a) When only invisible radiation is emitted (i.e. outside the range 400-750 nm).

CAUTION
INVISIBLE LASER RADIATION
WHEN PANEL OPEN AND
INTERLOCK OVER-RIDDEN
AVOID EYE OR SKIN
EXPOSURE TO DIRECT OR
SCATTERED RADIATION

(b) When both visible and invisible radiation may be emitted:

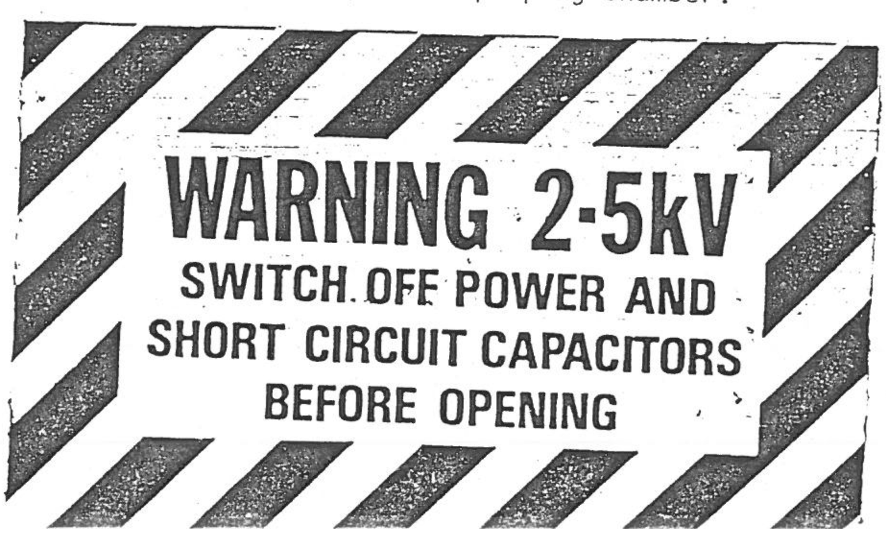


On the outside of the laser head cover, with the following information stated in the area below the line (U.S. market only).

i) max. output of laser (joules)
ii) pulse duration
iii) emitted wavelength
iv) laser medium

Also, a label stating date of manufacture in format "MANUFACTURED (MONTH)(YEAR)".

On the cover of each amplifier pumping chamber.



On the covers of the oscillator pumping chamber, the Q-switch module, the single pulse selector module and its driver unit.

DANGER

HIGH VOLTAGE

W. H. BRADY CO. STOCK NO. 45125

3. GENERAL DESCRIPTION OF THE LASER

3.1. OPTICAL HEAD

A holographic oscillator is a special type of laser in which the necessary coherence length is obtained by the use of bandwidth limiting etalons in the resonator and its satisfactory performance depends very largely on the care with which the oscillator components are set up by the J K Lasers test engineer. The layout of the optical components comprising this laser is given in Figure 1.

A selected quality ruby laser rod is used, 4" long and ¼" diameter. This is held in a close coupled type pumping chamber featuring a glazed ceramic reflector to provide diffuse coupling of the pump light into the laser rod. A flow of distilled water at an accurately controlled temperature provides optimum water cooling for the laser rod and the flashlamps.

The basic optical resonator is provided by a plane 20% reflecting, wedged output mirror and a 5m curvature concave, fully reflecting rear mirror. Operation in single transverse mode is assured by the inclusion of a small aperture, mounted in the end plate of the pumping chamber. A mechanical safety shutter is incorporated in the laser front plate.

The oscillator is pumped by a Xenon-filled flashtube driven by a high stability power supply. Q-switching is achieved by a Pockels cell and a polariser and the drive circuit is designed so that either one or two Q-switched pulses are emitted, as required (in this latter case, the pulse separation is adjustable between wide limits - see Appendix A - to allow use of the laser in a wide range of engineering applications). The Pockels cell features a KD*P crystal set in a sealed cell containing index matching fluid and anti-reflection coated windows to give a very low insertion loss. The Pockels cell windows are set at 5' to the crystal faces to minimise unwanted etalon effects within the cavity. The polariser consists of two plates mounted at the Brewster angle: no alignment is required, and the polariser is secured in the pumping chamber rear end plate.

A Q-switched laser will normally operate in several longitudinal modes at the same time. The number of modes depends on the natural fluorescent linewidth of the laser, the number of transverse modes operating and the degree of excitation of the laser rod prior to Q-switching. In order to reduce the number of modes operating and hence increase the coherence length of the holographic oscillator, additional wavelength selecting elements in the form of etalons are introduced into the laser resonator. The etalons are used in transmission and can therefore be coated with high reflectivity dielectric coatings to increase their finesse and reduce further the bandwidth of the laser. The etalons are thermally linked to the rod by the laser coolant, ensuring that any drift in rod temperature is compensated for by the etalons.

In order to prevent additional etalon effects within the resonator the output mirror and rod ends are wedged. The mirrors and etalons are mounted on an invar bar structure for high stability of the optical alignment. The beam from the oscillator is passed through a spatial filter to remove any unwanted perturbations from the beam profile, and to match the beam size to the amplifiers if fitted.

Amplifier stages are based on an 8" x $\frac{3}{8}$" Ruby rod which on its own will produce an output of 1 J. Used with a 4 x $\frac{1}{4}$" preamplifier an output of 3 J is available. With a second amplifier using an 8" x $\frac{5}{8}$" Ruby rod the 1 J output is increased to 10 J. To prevent self lasing within the amplifier the ends of the rods are cut at 3^{o} and anti-reflection coated, and to compensate for the beam offset caused by the rod wedge angles, the pumping chambers are skewed with respect to the optical axis. The amplifier rods are mounted in pumping chambers of similar construction to the oscillator one, but each 8" rod is pumped by four lamps, to ensure maximum uniformity of the output beam profile.

All systems incorporate a photodiode energy monitor which is used to monitor the laser output and may also be used to balance the beams of an external holographic system. Output signals are provided for oscilloscope display.

The holocamera is based on the standard 1 J or 3 J holographic laser, but is built onto a 1m x 0.5m base and incorporates all additional optics and plate holder to enable holograms to be taken wherever required. The system has external controls to vary the reference beam path length and beam ratio without removing the cover. The system is designed to be portable and optically stable so that it can be taken to any factory or industrial location to study problems on the spot instead of having to simulate them in the laboratory.

3.2. POWER SUPPLY UNITS

The power supplies needed for driving the flashlamps in the laser head are contained in one or two 4 ft. cabinets, depending on the system complexity. The power supply control unit, which incorporates the Pockels cell drive electronics and energy monitor interface unit, is situated either on top of the power supply cabinet in its own housing or built into the power supply cabinet.

The flashlamps are driven by conventional capacitor discharge supplies. The capacitors are charged from the constant current charging unit and the discharge is initiated by the series injection of a high voltage impulse from the trigger transformer. The timing and control circuits are built onto printed circuit cards situated in the control unit.

An overvoltage protection trip circuit board is situated on the power chassis of each charger and is powered directly from the incoming a.c. supply. Should the capacitor voltage exceed a set reference voltage the interlock circuit is broken and the capacitors are discharged. Once the trip level has been exceeded the circuit can only be reset by isolating the equipment from the mains.

On the 3J system the oscillator and preamplifier operate together from the oscillator charger. The total energy of the system is set with the amplifier capacitor voltage control. On the 10 J system, the amplifier charger operates both amplifiers at the set voltage.

All lasers are supplied with a closed circuit cooler system which works via a heat exchanger to the external mains supply. A heater is incorporated in the cooler unit to maintain the coolant temperature when the laser is not operating and the ambient temperature is below the recommended operating temperature for the coolant. Where mains water supplies of a suitable temperature are unavailable a refrigerator unit may be supplied.

3.3. THE CONTROL UNIT

The control unit has four sections labelled Power, Pockels cell, Oscillator and Amplifier, and all connections are via connectors on the rear of the chassis. The unit can be operated from the remote control box supplied. The controls are as follows:-

Enable Keyswitch. This forms a link in the interlock circuit and prevents unauthorised use of the laser.

On. Once power has been applied depression of this button will cause the capacitors to be charged and the laser to operate in the set mode.

Off. Depression of this button will stop the operating cycle of the laser and will dump the energy stored in the discharge capacitor bank. The laser is ready for re-use without further operation of the enable keyswitch.

Interlock. This neon lights when the power circuit breaker is closed. If any interlock switch remains open when the laser is operated the capacitor banks are dumped and this lamp remains lit.

The interlock circuit comprises microswitches on the power supply cabinet doors and on the end plates of the laser pumping chambers, a pressure switch in the laser coolant circuit, a key-controlled switch, an external access point at the rear of the power supply cabinet and a plug on the laser head cover.

Other conditions which will cause the interlock warning to light are actuation of the overvoltage trip and of the main thermal overload trip.

INT/EXT. This switch determines the triggering source for firing the flashtubes. In the 'INT' position triggering occurs at a steady repetition rate preset at the factory. In the 'EXT' position the laser may be fired by feeding a signal into the TRIG socket on the rear of the control unit or from the remote firing button on the box.

Single/Auto. The position of this switch determines whether the discharge capacitor bank will automatically recharge after firing. In the Single Shot position it will be necessary to depress the ON button each time it is required to charge the discharge capacitor bank. This is recommended as the SAFE way of operating the laser when only occasional single pulses are required.

Operation in the AUTO position is necessary for repetitive operation, either from the internal or an external pulse generator.

Oscillator/Amplifier Main Circuit Breakers. This switch is used to apply main power to the system. It does not initiate charging of the discharge capacitor bank. In addition, it protects the circuit under fault conditions.

Capacitor Voltage. This control sets the voltage to which the discharge capacitor bank will be charged. It should be set prior to charging to obtain reproducible results. It is important to note that once charged the discharge capacitor bank voltage cannot be reduced by reducing the potentiometer setting; this action will affect the voltage level only on subsequent shots. However, the discharge capacitor bank voltage level will always respond immediately to any increase in potentiometer settings.

Ready. This indicator is lit when the capacitor banks are charged and the laser is ready to fire.

Delay. This control sets the delay between firing the oscillator flashlamps and the amplifier flashlamps.

POCKELS CELL CONTROLS

Meter. The meter displays the voltage applied to the Pockels cell.

Bias. This Potentiometer sets the voltage applied to the Pockels cell.

Balance. This potentiometer controls the size of the signal sent to the Pockels cell to reduce the first pulse energy and hence balance the pulses.

Delay 1. This control sets the delay between firing the laser flashtubes and triggering the oscillator Q-switch.

Delay 2. This delay sets the pulse separation between the two laser pulses.

REMOTE CONTROL BOX

Laser Off. Switches off the laser and dumps the capacitors.

Laser On. Depression of this button will cause the capacitors to be charged and the laser to operate in the set mode.

Fire. With the INT/EXT switch in the EXT position, depression of this button will fire the laser.

Ready. This indicator is lit when the capacitor banks are charged and the laser is ready to fire.

4. OPERATING PROCEDURES

4.1. HOLOGRAPHIC OSCILLATOR

Step-by-step instructions for switching on and operating a holographic oscillator to its specified performance are listed below. (Refer to 4.3. for double pulsing details.)

1. Ensure that the tap water supply to the cooler is turned on or that the chiller unit (if used) is switched on.
2. Turn the "ENABLE" keyswitch clockwise to the horizontal position and lift the oscillator power breaker. The "INTERLOCK" lamp should be lit.
3. Switch on the cooler, wait a few minutes for the coolant to reach correct operating temperature.
4. Ensure that the INT/EXT and SINGLE/AUTO switches are set to give the mode operation required.
5. Check that the following controls are set as per data in Appendix B - System Control Settings.

   CAPACITOR VOLTAGE
   DELAY 1
   DELAY 2
   BALANCE

6. Switch on the Pockels cell.
7. Press the "ON" button. The capacitors will now charge and the laser operate in the set mode.
8. Press the "OFF" button to stop the laser operating and dump the energy stored in the capacitors.

4.2. AMPLIFIERS

In this section the controls available for the range of holographic amplifiers is briefly described and then the operating procedures are listed.

HLS2. The amplifier is controlled from the amplifier section of the control unit.

HLS3. The preamplifier is controlled by the oscillator control section of the control unit. The main amplifier is controlled by the amplifier section.

HLS4. Both amplifiers are controlled by the amplifier control section of the control unit. The operating procedure is as follows.

1. Switch on the holographic oscillator as outlined in Section 4.1., but do not press the "ON" button.
2. Set the amplifier delay as indicated in Appendix B.
3. Lift the mains power circuit breaker on the amplifier section of the control unit.
4. Set the "CAPACITOR VOLTAGE" control to give the required laser output. (Do not exceed the factory setting of this control as detailed in Appendix B.) When using lower drive levels than indicated, a different amplifier delay may be necessary to maintain equal double pulses.
5. Press the "ON" button. The capacitors will now charge and the laser operate in the set mode.

4.3. DOUBLE PULSE OPERATION

Switch on as detailed in Sections 4.1. and 4.2. and monitor the laser output on an oscilloscope by means of the integrating photodiode energy monitor supplied with the system. Adjust the "BALANCE" and "DELAY 1" controls until a signal similar to that shown in Figure 4 is obtained.

In general for pulse separations longer than 300 μS the "BALANCE" control is set at maximum and the two pulses are equalised by adjusting "DELAY 1".

For short pulse separations, "DELAY 1" is set to the optimum value and the two pulses are equalised by using the "BALANCE" control.

For short separations, where there is insufficient time for re-pumping the laser rod between pulses, and for long separations, where the laser is operating in the 'wings' of the flashlamp pulse, it may be found necessary to increase the input energy to the laser. Care must be taken to ensure that this level is reduced, however, before returning to a more efficient mode of operation. It is important to note that, once the flashlamp capacitor bank is fully charged, resetting the input voltage to a lower value before the lamps fire will have no effect. Therefore, it is important to switch the laser off and reset the input voltage before changing other operating conditions.

4.4. 1 HZ OPERATION

When operating at repetition rates faster than 6 pulses per minute, the equilibrium temperature of the rod is higher than the normal value. This requires a different setting of the micrometers of the intra-cavity etalons. Full details of the settings are given in Appendix B. After adjustment of the etalons, the resonator may require re-optimisation to restore the output energy or improve beam quality. The following alignment procedure should be carried out.

1. Switch off the laser and dump the capacitor.
2. Remove the aperture assembly from the oscillator pumping chamber end plate by loosening the grub screw situated under the cover fixing screw.
3. Operate the laser at the required repetition rate and capacitor voltage but with the Pockels cell switched off.
4. Monitor the oscillator output using the integrating photodiode supplied with the system and display the output on an oscilloscope.
5. Adjust the rear mirror only to obtain maximum output consistent with a smooth oscilloscope trace.
6. Check with burn patterns at the output of the oscillator that the output beam profile is symmetrical. NOTE: a small side beam may be seen at this point. (This is generated by the intracavity etalon and is quite normal.)
7. Switch off the laser and replace the aperture assembly.
8. Adjust the X-Y position of the aperture only to obtain maximum output consistent with a smooth oscilloscope trace.
9. Check with burn patterns that the output beam profile is truly circular and even. Some ring structure is normal in the beam profile at this stage.
10. Switch on the Pockels cell and check for satisfactory Q-switched performance.
11. Carefully remove any burn paper debris.

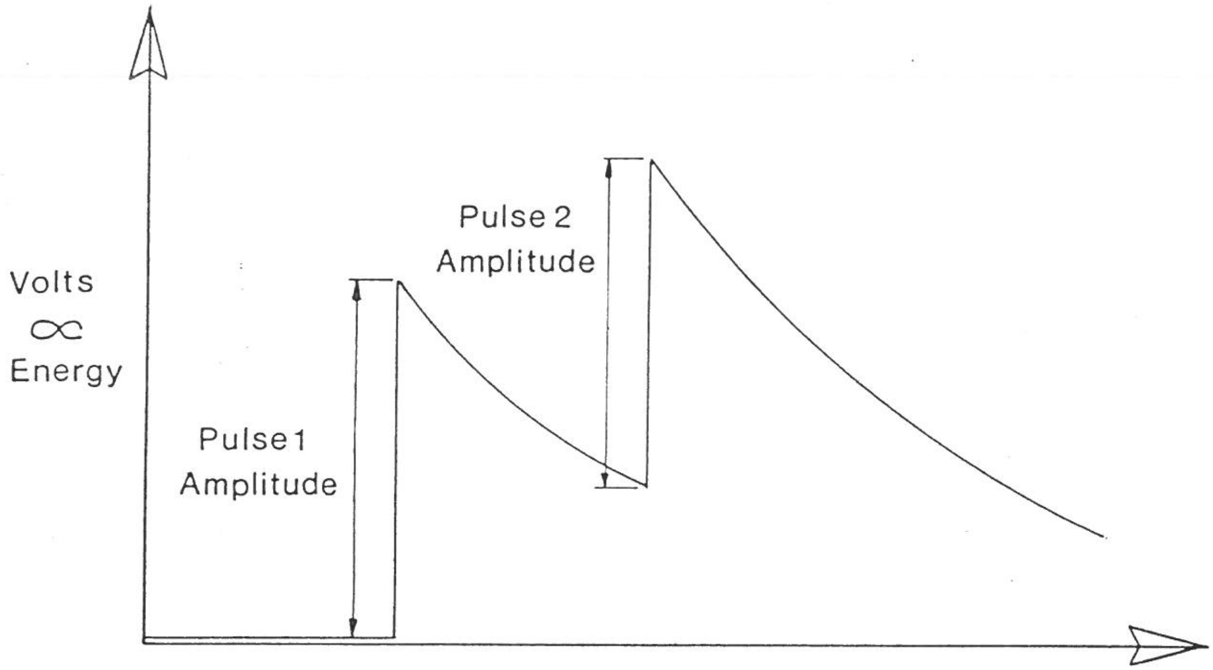


Fig. 4 C.R.O. DISPLAY OF DOUBLE PULSE LASER OUTPUT

5. MAINTENANCE

5.1. LAMP CHANGING

Changing of flashlamps will be necessary when they have aged to the extent that the required laser energy cannot be achieved with the available input energy, or if they become dirty on the outside due to contamination of the coolant, resulting in the loss of laser output. In this second case they can be cleaned, as detailed later, and re-used. Occasionally, a flashlamp may fail explosively and shatter inside the pumping chamber. In such cases, ensure that all fragments have been removed from the pumping chamber, to guard against any possibility of blockage.

The presence of other optical modules close to the pumping chambers means that these latter have to be removed bodily before the lamps are changed, but the mounting of the pumping chamber assemblies has been designed to make this operation very simple and to ensure that the chamber - and hence the ruby rod - fits back accurately so that the beam path is not disturbed.

Flashlamp Removal

1. Ensure that the cooler is switched off and that the power supply is disconnected from the mains electricity supply.
2. Ensure that the lamps are safe to work on. The safety probe(s) - to be found behind the cabinet doors - must be fitted into the discharge socket(s) according to the instruction label.
3. Remove the laser cover and then the two screws which secure the pumping chamber cover and remove this cover.
4. Slacken off the bleed screw on the end block. At this point a hissing sound will be heard as air enters the coolant circuit causing the level of the coolant to fall below the baseplate.
5. Carefully slide the lamp clips off the flashlamp ferrules.
6. Carefully slide the PTFE gaitering tubes (if fitted) away from the pumping chamber end blocks.
7. Remove the four screws which secure the baseplate to the mounting plate.
8. Carefully lift away the complete pumping chamber assembly.
9. Remove the two retaining screws and the clamp plate from the '0' ring seal at each end of the lamp.
10. Gently move the lamp to and fro to unseat the '0' rings. When the '0' rings are free on the lamp, carefully withdraw it out of the pumping chamber.

Flashlamp Replacement

1. Ensure that the flashlamps are clean; any traces of adhering 'O' ring should be carefully removed, taking care not to scratch the envelope.
2. Slide the lamps into position in the pumping chamber, ensuring the polarity is correct (+ lead to red terminal). Unless the original 'O' rings are perfect, use new ones, rolling them into position from each end.
3. Replace the pumping chamber by a reversal of the procedure for removing it, using new 'O' rings unless the old ones are perfect. (Take particular care when replacing the gaitering tubes and when sliding the clips back onto the lamp ferrules.)
4. Switch on the coolant pump and look carefully for any leaks.

NOTE: Flashlamps in quad. pumping chambers are held in place by castellated clamping nuts. These are removed and replaced using the special tool supplied in the laser tool kit.

Flashlamp Cleaning

Discolouration of the flashtubes can either be external or internal. First clean the lamp envelope in isopropyl alcohol. If discolouration persists, and is definitely on the outer surface, clean again with dilute nitric acid, keeping it away from the electrodes. If colouration is internal and extends far beyond the electrodes, the flashtubes probably need replacing. Generally, removal of external discolouration from the flashtubes should be accompanied by flushing of the cooling system and refilling with fresh coolant.

5.2. COOLER MAINTENANCE

The materials and components of the cooling system have been carefully chosen to minimise the possibility of contamination of the de-ionised water, and the primary maintenance task is thus just to check the level of the water. This can be done with the cooler in situ by unscrewing the large cap on the top of the stainless steel reservoir: the level, when the tubing and pumping chambers are full of water, should be just above the top of the heat exchanger coil. Do not overfill, or the water may spill over the top when the laser head is drained to change a lamp.

Depending on the frequency and conditions of operation, it may be necessary occasionally to change the coolant and possibly clean the system. If a marked drop in output occurs, check the flashtubes first. If these are contaminated on the inside through electrode sputter, but are clean externally, then it is probably not a coolant problem, and lamp replacement is indicated if the desired laser output cannot be achieved with the available input pumping energy. The transparency of the coolant should be checked, however, and, if in doubt, replaced first. If examination of the external surface of the lamps or the interior of the reservoir shows contamination, then the coolant will certainly have to be changed.

Changing the Coolant

1. Drain the laser head by removing the bleed screws in the pumping chamber(s).
2. Remove the screws holding the cooler chassis to the cabinet.
3. Unplug the electrical connector.
4. Undo the quick-release coolant connectors, and slide the cooler unit out clear of the cabinet.
5. Remove the lid of the reservoir and empty out the coolant.
6. Thoroughly clean every surface inside the reservoir, paying special attention to the corners and the coil: a paper towel is ideal for the purpose.
7. Replace the bleed screw in the pumping chamber.
8. Refill the reservoir with clean water, temporarily replace the lid, fit the cooler in the cabinet and remake the electrical and coolant connections.
9. Switch the coolant pump on and flush for a few minutes.
10. Repeat Steps 1, 3, 4 and 5.
11. Replace the bleed screws and refill the reservoir with de-ionised water.
12. Refit the cooler in the cabinet.

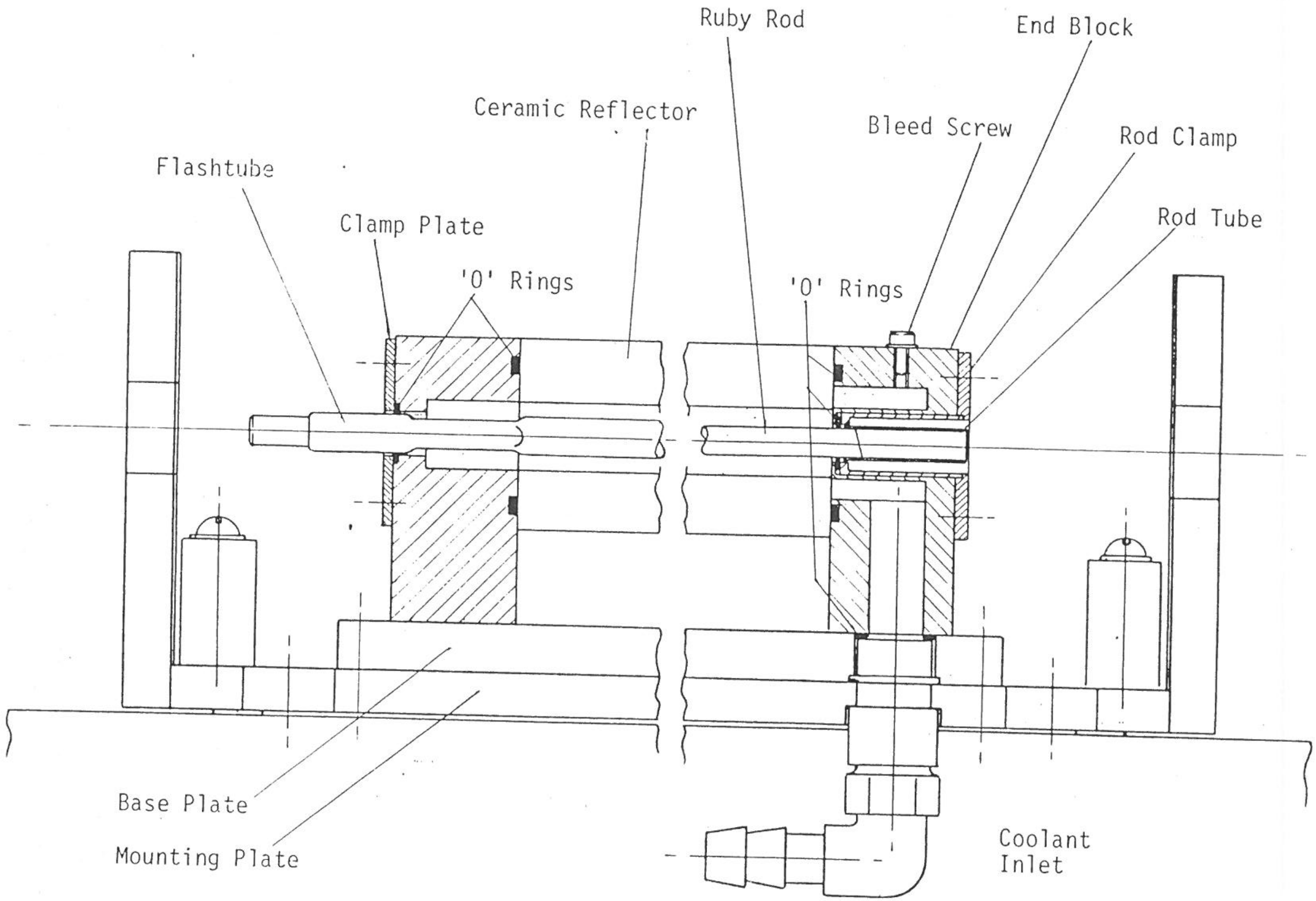


FIG. 5: CROSS-SECTIONS OF LASER HEAD ASSEMBLY SHOWING FLASHTUBE (LEFT) AND ROD (RIGHT)

APPENDIX A - SYSTEM PERFORMANCE.

(For Laser Serial No:)

In this Appendix the Basic specifications are given for this particular system. The system control settings to achieve this performance are given in Appendix B.

WAVELENGTH	694 nanometres
OUTPUT ENERGY	
MAX. REP. RATE	
COHERENCE LENGTH	Greater than 1m
PULSE DURATION	30 nS nominal
POLARISATION	Vertical

APPENDIX B - System Control Settings

(for laser serial no)

In this appendix the final system control settings from factory testing are recorded. They provide a useful reference for both initial user operation of the system and subsequent changes to operating conditions as the components age or are replaced due to damage.

Pockels Cell Bias		
Energy Monitor Calibration		
Coolant	Distilled Water	
Coolant Temperature	20 C	
Micrometer Settings	top	side
Pockels Cell		
Etalon 1		
Etalon 2		
Spatial Filter Lens		
Spatial Filter Pinhole		

CONTROL UNIT SETTINGS

Pulse Internal /uS	DELAY 1	DELAY 2	OSC CAPACITOR VOLTAGE	AMP DELAY	AMP CAPACITOR VOLTAGE	BALANCE
Single Pulse						
1						
10						
100						
200						
400						
600						
800						

* Adjust these settings to maintain equal double pulses.